

## SOLUBILITY AND MISCIBILITY OF HYDROGEN PEROXIDE



Because of hydrogen peroxide's chemical and thermodynamic activity, precautions should be observed when considering solutions of  $\text{H}_2\text{O}_2$  with various organic and inorganic compounds. Although violent reactions upon mixing are the exception, such reactions have been observed. Many  $\text{H}_2\text{O}_2$  solutions may be fairly stable when undisturbed but are subject to violent detonation under certain conditions. The addition of any material which may be oxidized or reduced should be suspect, particularly as the relative concentrations approach stoichiometric proportions. For these reasons, it is suggested that appropriate references be consulted in detail to define the chemical nature of the proposed solution as well as the solubility of the solute before solutions of  $\text{H}_2\text{O}_2$  with other materials are attempted.

In general, concentrated  $\text{H}_2\text{O}_2$  solutions are completely miscible with most organic liquids (including ethanol, isopropanol, acetone, ethyl cellosolve, pyridine, etc.) that are miscible with water in all proportions. In addition, hydrogen peroxide is more miscible than water in a number of organic materials, such as methyl methacrylate, dimethyl and diethyl phthalate, ethyl acetate, and aniline. Compounds with which hydrogen peroxide is nearly immiscible include petroleum ether, toluene, styrene, carbon tetrachloride, chloroform, kerosene, fuel oil, and gasoline. Hydrogen peroxide and its aqueous solutions also possess, in general, solvent or solute relationships that are similar to water. The results of several experiments show that sodium fluoride, potassium nitrate, various potassium or sodium phosphates, potassium chloride, and sodium or potassium sulfate are more soluble in  $\text{H}_2\text{O}_2$  than in water. Sodium nitrate, sodium chloride, silver nitrate, lead nitrate, and lithium nitrate and sulfate are less soluble in  $\text{H}_2\text{O}_2$  than in water. Chlorine and iodine are only slightly soluble in anhydrous  $\text{H}_2\text{O}_2$ .

In consideration of the materials compatibilities of various lubricants with  $\text{H}_2\text{O}_2$ , the solubilities of several organic compounds in propellant-grade  $\text{H}_2\text{O}_2$  are discussed in detail below.

# Compatibility of 90% Hydrogen Peroxide with Potential Lubricants

## Halogenated Aliphatic Hydrocarbons

- Polytetrafluoroethylene (solid)
- Tetrafluoroethylene-hexafluoropropylene copolymer (solid)
- Polychlorotrifluoroethylene (molecular weight < 800)
- Polychlorotrifluoroethylene (molecular weight > 800)
- Perfluorokerosene
- Dispersion of Polytetrafluoroethylene in Trichlorotrifluoroethane (solid)
- Perchloropentacyclodecane (solid)
- Perfluorodiethylcyclohexane (mixed isomers)
- Dichlorodecafluoroheptane
- Chlorofluoro Hydrocarbon (approximate molecular weight 725)
- Chlorofluoro Hydrocarbon (approximate molecular weight 1000)
- Fluorinated Hydrocarbon (77.4 percent F; approximate molecular weight 640)
- Polychlorotrifluoroethylene (approximate molecular weight, 775; 80 percent halogens)

## Silicon Compounds

- Silicon Fluorides
- Tri(p-trifluoroethyl phenyl) Silicon Fluoride
- Trilaurylsilicon Fluoride
- Trio (3,5,5-trimethylhexyl) Silicon Fluoride
- Dimethylpolysiloxanes
- Dimethylpolysiloxane (2 -to 500 Cs)
- Fluoropolysiloxanes
- $\text{HCF}_2(\text{CF}_3)\text{CH}_2\text{O}[\text{Si}(\text{CH}_3)_2\text{O}]_n\text{CH}_2(\text{CF}_2)_5(\text{CF}_2\text{H})$ , Fluoropolysiloxane,  $n=1-26$
- Cyclic Fluorosiloxane (solid)
- Fluorosiloxane Elastomer (solid) Made From  $\text{CF}_3(\text{CH}_2)_2\text{Si}(\text{CH}_3)_2$
- Mixed Cyclic Fluorosiloxane (solid)

- Dimethylpolysiloxane-Cyclic
- Fluoropolysiloxane Blends
- Fluorosiloxane Grease (No. 33 + inorganic gelling agent)
- Fluorosiloxane Grease (No. 34& + inorganic gelling agent)
- Mixed Diethylpolysiloxane and Cyclic Fluoropolysiloxane
- Mixed Dimethylpolysiloxane (average molecular weight < previous compound)

#### Halogenated and Nonhalogenated Aromatic Hydrocarbons

- 3-Heptyl-m-terphenyl
- Isopropyl-m-terphenyl
- Dinonylnaphthalene (mixed isomers)
- 1,3-Bis (trifluoromethyl) Benzene
- 2,3,5,6-Tetrachlorofluorobenzene (solid)
- 1,3,5-Trimethyl-2,4,6-Trifluorobenzene (solid)
- 1,3,5-Trimethyl-2, 4-Difluorobenzene
- Hexafluorobenzene
- 2, 5-Dichlorobenzotrifluoride
- 2-Fluorobiphenyl (solid)
- 3,3'-Difluorobiphenyl (solid)
- 4,4'-Difluorobiphenyl (solid)
- 3,6,4'-Trifluorobiphenyl (solid)

#### Esters

- Mixed Fluoroalkyl Camphorates Fluoroalkyl-HCF (CF<sub>2</sub>)<sub>n</sub> CH- n =3,5,7
- Bis-1H, 1H,5H-perfluoropentyl Camphorate
- Bis-1H, 1H,11H-perfluoroundecyl Camphorate (solid)
- Tetrabutyl Pyromellitate
- Mixed Fluoroalkyl Pyromellitates
- Bis (2,2,3,3,4,4,5,5,-octafluoropentyl)3-methylglutarat
- Bis (2,2,3,3,4 ,4,5,5,6,6,7,7,-dodecafluoroheptyl)3-methylglutarate
- 2,2,3,3,4,4,-Hexafluoropentyl 1,5-bis (trimethyl acetate)
- big(I-methylcyclohexylmethyl) Sebacate
- Poly (1,1,5,5-tetrahydrohexafluoropentamethylene adipate)(solid)

- Bis (2 -ethylhexyl) Chlorendate
- Dibutyl Chlorendate

#### Nitrogen Compounds

- Hexadecyltriphenylurea
- 2,2'-Dinitrophenyl Ether (solid)
- 4,4'-Dinitrophenyl Ether (solid)
- 2,6-Difluoro-3,5-dinitrochlorobenzene (solid)
- 2,4-Dinitro-5-fluorobromobenzene (solid)
- Perfluorotributylamine

#### Perfluoro Compounds

- Polytetrafluoroethylene (solid)
- Tetrafluoroethylene-hexafluoropropylene Copolymer (solid)
- Perfluorokerosene
- Perfluorodiethylcyclohexane (mixed isomers)
- Mixed Perfluorocyclic Ether, C<sub>8</sub>F<sub>16</sub>O (five- or six-membered ring with side chain, oxygen in the ring)
- Perfluorotributylamine
- Perfluorodihexyl Sulfide
- 4-Chloro-3,5-difluoronitrobenzene (solid)
- 3,3'-Difluoro-4,4'-dimethoxybiphenyl (solid)

#### Ethers

- Bis(m-phenoxyphenyl) Ether
- 1,4-bis(cresoxy) Benzene (mixed isomers)
- CF<sub>3</sub>CF<sub>2</sub>O(CF<sub>2</sub>)<sub>2</sub>SF<sub>5</sub>
- 2,2'-Dinitrodiphenyl Ether (solid)
- 4,4'-Dinitrodiphenyl Ether (solid)
- 4-Fluoro-6-methoxyacetanilide (solid)
- 3,3'-Difluoro-4,4'-dimethoxydiphenyl Sulfoxide (solid)
- 3,5-Difluoro-6-methoxyacetanilide (solid)
- Mixed Perfluorocyclic Ether, C<sub>8</sub>F<sub>16</sub> (five – or six-membered ring with side chain, oxygen in the ring)

Source : <http://www.diyspaceexploration.com/solubility-and-miscibility-of-hydrogen-peroxide/>